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Bare Neutron Counter and Neutron Monitor Response to Cosmic Rays during a 1995 Latitude Survey

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Neutron monitors are ground-level detectors of cosmic ray-induced atmospheric secondary particles (mostly neutrons) that are employed world-wide to study variations in the flux of galactic cosmic rays and solar energetic particles in the GeV regime. The neutron monitor standard design (NM64) minimizes detector response to neutrons below ∼10 MeV produced by cosmic ray interactions in the ambient medium. Increasingly, however, such neutrons are of interest as a means of obtaining spectral information on cosmic rays, for studies of soil moisture, and for nuclear threat detection. Bare neutron counters, which lack the lead and polyethylene of NM64 monitors, can detect such neutrons, but comparatively little work has been done to characterize the dependence of their count rate on cutoff rigidity. We analyze data from three bare neutron counters operated on a ship together with a 3-tube NM64 monitor from November, 1995 to February, 1996 over a wide range of magnetic latitude, i.e., a latitude survey. When the ship was near land, the bare/NM64 count rate ratio was dramatically higher. Considering only data from open sea, the bare and NM64 pressure coefficients are not significantly different. We determine the response function of these bare counters, which is weighted to Galactic cosmic rays of lower energy than the NM64. This measurement of the response function may improve determination of the spectral index of solar energetic particles and Galactic cosmic rays from a comparison of bare and NM64 count rates.

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